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USSR Report

ENERGY

No. 47

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CONTENTS

ENERGY CONSERVATION

IMPROVED METHODS FOR PLANNING GREATER PRODUCTION QUALITY

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 10, Oct 80 pp 76-80

/Article by A. Seleznev and Ye. Suvorov: "The Improvement of Methods for Planning Production Quality (at Ukrainian SSR Electrical Machine Building Enterprises)"/

/Text/ The demand for electrical machines and devices as well as the technical requirements for them is growing greater under the influence of scientific and technical progress. This is explained by the increase in the level of the electrification of production, a rise in the unit capacity of the basic technological machine units, the introduction of continuous production processes, etc.

The experience of the electrical engineering industry shows that a systematic increase in production quality is achieved, first and foremost, through the introduction of new equipment. According to information from the Ukrainian SSR TsSU /Central Statistical Administration/, the republic's electrical engineering enterprises are manufacturing more than 100 types of new machines and equipment annually while at the same time removing several dozen from production. As a result, the ratio of the number of obsolete types of products removed from production to the number introduced into production for the years of the 9th five-year plan, for example, amounted to from 28 to 45 percent, i.e., it was not optimum. This is one of the negative tendencies in the process of changing the production mix and increasing production quality.

Of course, with scientific and technical progress, it is impossible to expect an equality of indicators for the introduction into production of new types of machines and equipment and the removal from production of obsolete ones, which is explained by the following:
--on one hand, the growth of new functional tasks in the physical production area, combined with an increase in its mechanization and automation level, leads, in turn, to a widening of the list of machines and equipment produced by industry;
--on the other hand, new types of machines and equipment, as a rule, have broader functional possibilities in comparison with those they have replaced, and that is why the tempo for broadening the production list is slower.

The rate for introducing new articles into production may be up to the limits specified for the leading ones in comparison with the rate of removing obsolete articles from production, the more so as this is sometimes done to satisfy the interests of national economic demands. However, the ratio of these rates must be substantiated. Otherwise, the current and one-time costs connected with the parallel nature of the production of machines and equipment of one functional purpose, but of different quality, increase.

Table 1

Plant	The Number of Obsolete Articles Removed from Production as a Percentage of Those Being Put into Production, by Years					
	1971-1975	1976	1977	1978	1979	1976-1979
Elektrotyazhmash/Heavy Electrical Machinery/	51.8	400.0	250.0	2 0.0	125.0	220.0
Electrical Machinery	109.0	72.5	92.0	67.8	65.6	73.6
Electrical Engineering	75.0	-	-	90.0	50.0	46.9
Electrical Equipment	64.0	100.0	33.3	33.3	-	33.3
Elektromashina/Electrical Machinery/	98.2	166.7	150.0	75.0	100.0	100.0
Yuzhkabel'/Southern Cable/	63.2	25	100.0	-	100.0	66.7
Total	97.3	80.0	87.8	90.0	63.1	80.6

Let us analyze the indicated ratios by using the electrical engineering industry enterprises of Khar'kov(table 1) as an example.

The data presented in table 1 show that the dynamics of the indicator analyzed, in a time interval, both for the group of enterprises as well as for the specific plants, are mixed. This testifies to the fact that the existing mechanism for developing plans to increase production quality by introducing new and removing obsolete machinery and equipment from production has not been sufficiently mastered and is not based on common criteria for the industry as a whole. This is found especially when analyzing the fulfillment of the annual technical, industrial, and financial plans and the five-year plans for increasing production quality.

It is evident from table 2 that the planning indicators for the introduction of new articles into production were fulfilled for the group of enterprises as a whole in the 9th five-year plan by 116.7 percent, and for the four years of the 10th five-year plan by 114.7 percent; for the removal from production of obsolete articles the percentages were 105.8 and 106.7 respectively. The situation is even worse at the individual enterprises. Thus, at Plant Elektromashina the fulfillment of the planned task on introducing new articles into production in the 9th five-year plan was 84.6 percent, and it was 91.5 percent for the removal of obsolete articles from production; and for the four years of the 10th five-year plan the figures were 118.1 and 108.3 percent respectively.

Table 2
(in percentages)

	Plan Fulfillment, by Years	
	1971-1975	1976-1979
Introduction of new articles--total......	116.7	114.7
among the following plants:		
Electrical Machinery....................	112.3	115.7
Elektrotyazhmash........................	251.2	100.0
Elektromashina..........................	84.6	118.1
Removal of obsolete articles from production--total..........................	105.8	106.7
among the following plants:		
Electrical Machinery....................	105.4	108.2
Elektrotyazhmash........................	130.2	100.0
Elektromashina..........................	91.5	108.3

It is known that the economic effectiveness of changing the production mix, i.e., increasing production quality, depends on their actual output volumes, i.e., from the extent of the sale of new equipment to the national economy. Therefore, a quality increase in the economic sense must, apart from the introduction of new articles and the removal of obsolete ones from production, signify the attainment of the optimum output volumes of the introduced products, satisfying the national economic demand for them. From this viewpoint the process of increasing production quality is more fully and deeply characterized by data reflecting the proportion of new articles in the total volume of commodity production.

It is evident from table 3 that in the period under analysis the portion of articles which are new or introduced for the first time in the USSR stays practically at a constant level within the total volume of commodity production. A decrease in the proportion of products manufactured for more than seven years, within the total volume of commodity production, is a positive tendency.

At the electrical engineering enterprises of Khar'kov in the 9th five-year plan the growth rate of indicators for products which are new or introduced for the first time into the USSR, within the total volume of commodity production, has a tendency to decrease. There has also been observed the positive tendency of a

Table 3
(in percentages)

	Proportion of new articles in the total commodity production volume, by years							
	1971	1972	1973	1974	1975	1976	1977	1978
New production--total.............	8.1	10.8	9.6	7.9	8.4	9.1	9.0	9.7
Including								
introduced for the first time in the USSR..............	3.9	5.7	4.1	4.1	4.0	4.2	4.7	4.3
manufactured more than 7 years.....	44.1	43.2	39.3	34.9	35.8	36.7	35.2	35.1

decrease in the proportion of articles manufactured 5-10 and more years ago, and a corresponding increase in the share of products manufactured up to five years. A comparison of these data indicates that the intensification of new product production volumes occurs mainly in two or more years from the beginning of its series production. If one considers that the system for managing scientific and technical progress in the electrical engineering industry provides for the economic stimulation of new equipment precisely in these years, i.e., in the first three years of series production, then one should note its inadequate effectiveness. This may be construed in two ways: the manufacturing rate recorded for new production satisfies the economic demands of the manufacturer enterprises or the existing system does not give economic advantages when increasing the tempo of manufacturing a given product. There is a dual character to such a problem: it is one of the prerequisites for the necessity of the further improvement of planning and the economic stimulation of new equipment and the increase of production quality as a whole.

To maintain a methodological unity in planning production quality, the development of these plans must be grounded on the technical and economic basis of the quality planning indicators of current and one-time costs connected with their achievement, and the economic impact obtained for reflecting it in other sections of the technical, industrial, and financial plan and the set contribution of stimulation funds.

We will examine the relationships of these indicators by using the example of those that have been achieved at the electrical engineering industry enterprises of Khar'kov in the 9th and 10th five-year plans(table 4). For comparability of data, the indicator dependences are being analyzed for increasing the quality(reliability, durability) of articles, the cost of this increase, and the economic impact resulting from it.

Table 4
(in percentages)

Plant	Fulfillment of indicators, by years					
	Increase in the quality of articles		Costs of the increase in quality of articles		Economic impact of increasing the quality of articles	
	1971-1975	1976-1979	1971-1975	1976-1979	1971-1975	1976-1979
Electrical Machinery........	108.3	91.1	97.3	86.6	70.6	112.9
Elektrotyazhmash............	107.4	100.0	-	396.0	151.7	103.6
Elektromashina..............	100.0	128.6	42.9	76.4	89.0	112.4
Electrical Engineering......	102.2	100.0	103.0	123.1	102.9	127.4
Electrical Equipment........	110.8	100.0	82.5	-	100.1	104.0
Yuzhkabel'	262.5	100.0	18.9	514.1	56.6	196.8
Total..................	110.0	100.0	29.8	126.0	87.8	116.3

It follows from table 4 that the plans for increasing the quality of articles have been fulfilled by all enterprises with the exception of the electrical machinery plant. The fulfillment of the plan, on the whole, for the group of enterprises was 110 percent in the 9th five-year plan and 100 percent for the four years of the 10th five-year plan. Moreover the assimilation of planned costs to increase the quality of articles was 29.8 percent for this same group of enterprises in the 9th five-year plan and 126 percent for the four years of the 10th five-year plan.

A comparison of the data in table 4 shows that only the electrical machinery plant had an increase in quality of its products that was within the allowable limits connected with the assimilation of costs planned for these goals--the evidence of the validity of the indicators specified in the five-year plans. There is no such connection for the remaining enterprises: at Yuzhkabel' the fulfillment of the plan for increasing quality was 262.5 percent in the 9th five-year plan, and the assimilation of planned costs was 18.9 percent; for the four years of the 10th five-year plan, the percentages were 100 and 514.1 respectively, etc.

A similar picture is also seen in the connection of indicators for increasing the quality of articles and assimilating the costs set aside for these goals with the indicator of the economic impact due to the increase in quality of these articles. The actual economic impact for the group of enterprises analyzed amounted in the 9th five-year plan to 87.8 percent of the planned level while the plan to increase the production quality was realized by 110 percent and the figures for the four years of the 10th five-year plan were 116.3 and 100 percent respectively. The change in the cited indicators within the specified limits places in doubt the plan's validity to increase production quality also in this direction, especially for the separate enterprises. Thus, the task of increasing production quality was fulfilled at Yuzhkabel' in the 9th five-year plan by 262.5 percent and the economic impact obtained through this measure was 56.6 percent; for the four years of the 10th five-year plan the assimilation of costs for these goals amounted to 514.1 percent and the economic impact obtaines was 196.8 percent, etc.

We will analyze the dependence of the amount of expenditures to increase production quality and the size of the economic impact obtained because of this by comparing the planned time periods for the reimbursement of these costs with the actual ones(table 5).

Table 5
(in percentages)

Plant	Relationship of the actual time periods of reimbursement to the planned ones, by years	
	1971-1975	1976-1979
Elektrotyazhmash	-	400.0
Electrical Machinery	-	75.0
Elektromashina	63.5	75.0
Electrical Engineering	50.0	96.0
Electrical Equipment	100.0	-
Yuzhkabel'	75.0	1500.0
Total	37.3	112.5

The data in table 5 confirm that the planned indicators for increasing the reliability and durability of articles were technically and economically based only at the electrical engineering plant. This has not been observed on the whole at the rest of the plants for the group of enterprises analyzed.

To further improve the planning of production quality it is advisable, in our view, to use a system which would provide for the working up of a generalized quality indicator interconnected with such indicators of an enterprise's cost accounting activities as costs for increasing quality and the economic impact obtained through this. The generalized indicator must quantitatively describe production quality.

The cost indicators are capable of reflecting the dynamics of the producible use values, including the natural ones--to describe the change in quality of specific products. However, it is advisable to design a generalized indicator which will fully evaluate the change in quality of separate types of articles and the full physical production volume of the enterprise. Let us examine the construction of such an indicator.

Natural(single) indicators describe the individual properties of an article and that is why even a basic one cannot totally evaluate the quality of a gross product. A change in single indicators is connected with the cost of specific material and labor resources on a national economic scale. Thus, their increase can lead to additional production costs during the simultaneous savings of operational costs. In the final analysis any change in the natural indicators is synthesized in the cost of the article and the economic impact of its output.

The price of an article of a higher quality category(Ts_n) and the economic impact of its output(E_k) amount to the limit price(Ts_1) which, thus, is also a generalized indicator of the quality of a given article.[1]

Then using the natural measurers of production volume, we determine the generalized absolute indicator of production quality at the enterprises according to the following formula:

$$T_{b.k.e} = T_{b.k} + \Sigma E_k,$$

where $T_{b.k}$ is the output volume for the highest category of quality products in operational prices, in thousands of rubles; and E_k is the economic impact from the output from the highest category of quality products, in thousands of rubles.

Planning the output volume of the highest category of quality products in operational prices($T_{b.k}$) has great economic importance. In the first place, the given indicator reflects the physical mass of high-quality production which permits the linking of cost and natural measurers of production volume and, correspondingly, the production indicators and consumption of a specific product. Secondly, the production of a given volume is linked with specific labor and, consequently, with the costs of the enterprise's material and labor resources for the output of high-quality products. Therefore, the indicator ($T_{b.k}$) can be criterional when determining the contribution of the enterprise to an increase in production quality, i.e., it can be used as a fund generator with an extra economic stimulation fund charge.

In the 12 August 1979 instructions on a system for planning and calculating production growth of the highest category of quality articles(basic positions), a given indicator was expressed in relative values, in the form of the ratio of products of the highest category of quality to the total volume of commodity production(U_k).[2]

The economic content of the indicator(ΣE_k) is that it strengthens the economic interest of the enterprise to produce highly effective products on a national economic scale.

The volume of products of the highest quality category and the economic impact of their production depends upon the introduction of measures of scientific and technical progress the qualitative and quantitative characteristics of which are synthesized in the costs for improving the designs of articles(Z_k); progressive technology, mechanization and automation($Z_{t.a}$); modernization and substitution of obsolete equipment, outfittings, and tools($Z_{m.z}$).

Thus, the indicators ($T_{b.k}$) and Σ have a common characteristic--they change depending on the value of the costs involved in increasing production quality. The characteristic under consideration can be set on the basis of a mechanism of production quality planning indicators according to a resource ceiling for scientific and technical progress measures or, on the contrary, the planning of costs according to a production quality criterion. If the correlating absolute indicator ($T_{b.k.e}$) is expressed in relative values according to the formula $U_{k.e} = U_k + U_e$, where U_e is the economic impact level from the output of articles of the highest quality category relative to the volume of commodity(gross) production, then it is presented in the form of a composite function of several variables: $U_{k.e} = \varphi(Z_k, Z_{t.a}, Z_{m.e})$.

The correlative dependence model $U_{k.e}$ may be depicted by a linear equation, including the three variables(Z_k, $Z_{t.a}$, $Z_{m.z}$), of the following type:

$$U_{1,2,3} = a_0 + a_1x + a_2x_2 + a_3x_3^3$$

By analogy U_k and U_e, constituent correlating indicators, are worked out.

Let us examine the synthesis of the correlational model of the electrical engineering plant. Here the multiple regression equation in the standardized scale $t_u = b_1t_1 + b_2t_2 + b_3t_3$, where $b_{1,2,3}$ are regression coefficients; $t_{1,2,3}$ are the values of the variables, after appropriate calculations, take the form $t_u = 0.119t_1 + 0.866t_2 + 0.339t_3$.

From the equation it follows that the quality production indicator(U_k) is influenced significantly by the resources directed toward the introduction of progressive technology, the mechanization and automation of production($b_2 = 0.866$), and the improvement of product designs($b_3 = 0.339$).

After recalculating the constant factors, the multiple regression equation, on a full scale, looks like the following representation:

$$U_k = 0.4093\ Z_{m.z} + 0.01543\ Z_{t.a} + 0.0983\ Z_k - 0.63.$$

The economic importance of the proposed mechanism for planning production quality is that the development of planning indicators is based on the optimum utilization of materials and manpower.

FOOTNOTES

1. EKONOMICHESKAYA GAZETA, 1976, No 51.

2. EKONOMICHESKAYA GAZETA, 1979, No 35.

3. A. K. Mitropol'skiy, "The Technique of Statistical Calculations," Moscow, NAUKA, 1971, p 460.

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ELECTRIC POWER

NEW SOLAR ELECTRIC POWER STATION CONSTRUCTION

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 5 Nov 80 p 4

[Article by P. Garadzha: "A Solar Electric Power Station is Being Born"]

[Text] An experimental SES [solar electric power station] is being created in the Crimea around the village of Mysovyy in Leninskiy Rayon.

This site was not selected by accident--there is a construction base here. It is of no small importance that a small town of builders is growing up here at the same time. Aktashskoye Lake is also nearby which ensures sufficient water for the needs of the experimental SES.

Similar tower-type, one to ten megawatt SES's are now being constructed in several developed capitalist countries. Our first station is a five-megawatt one. However, after SES-5 produces a power current and its operational potential has been determined, plans call for construction to begin on a larger SES. Today it is expected to have a capacity of roughly 200-300 megawatts. There is already a serious demand for the wide utilization of solar energy. So a station will be built here in the Mysovyy area.

This is the lay-out of the experimental SES. A metal tower, 70 meters high, has been erected in the center of a field of heliostats(concave mirrors) which have been turned, with the help of automatic equipment, behind the sun. Reflected rays are focused on the heating surface of the steam generator--a solar boiler mounted on the tower. The temperature in it reaches 300 degrees. The water evaporates and the pressurized steam moves through pipelines into the machine room toward the turbines.

But how will this work at night or on overcast days?

"The problem of storage is only one of those we encountered in the operation," says the chief engineer of the project Otto Arturovich Vindberg. "Sufficiently large capacities which will retain hot water and steam reserves, necessary for the operation of the turbines during an unfavorable period of time, will be created at the SES.

In addition to the Riga department of the institute Teploelektroproyekt [All-Union State Institute for the Planning of Electrical Equipment for Heat Engineering Structures] (the general designer), the most active participants in the creation of a plan for a more powerful station are the State Scientific Research Power

Institute imeni G. M. Krzhizhanovskiy, the Thermal Engineering VNII[All-Union Scientific Research Institute] imeni F. E. Dzerzhinskiy, the institute Gidroproyekt[All-Union Planning, Surveying and Scientific Research Institute imeni S. Ya. Zhuk], and other organizations.

The size of the SES will be impressive. The tower will be 250 meters high. Its "small needle" will soon make an appearance in the Crimea. There will be four complete ones. The station will have four modules with a capacity of from 50 to 80 megawatts each. The only things that will not be there are viewing platforms and restaurants on the towers.

Heliostats will be placed around each "needle" for an area of nine square kilometers. There will be 26,000 5x5 meter heliostats.

"An automatic device will correct the movement of each mirror that is affected by wind, rain, and other external factors," explains the general director of Krymenergo[Crimean Regional Administration of Power System Management] Evgeniy Fedorovich Shevchenko. "It will make sure that the heliostats do not stray from their aim so that the solar rays hit one point.

A decision has been made to start the construction of the experimental SES-5 this year. Then will come SES-200 or SES-300.

8524
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ELECTRIC POWER

PROBLEMS WITH PRODUCTION OF MOTORS FOR KATEK

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 23 Nov 80 p 2

/Article by Ya. Karpel', chief specialist electrician of the Rostov department of the institute Teploelektroproyekt: "Time Does Not Wait"/

/Text/ KATEK/Kansko-Achinskiy Fuel Energy Complex/ is well-known to all. It has been mentioned in many party and government decisions on developing energy for the country as one of the major projects of our economic system. Its thermal electric power stations, each with a capacity of 6.4 million kilowatts, must provide electric power to Central Siberia, the European part of the USSR, and Kazakhstan. Naturally, stations of this size require new equipment. The leading ministries in creating such equipment are Minenergomash/Ministry of Power Machine Building/ and Minelektrotekhprom/Ministry of the Electrical Equipment Industry/. They are doing a great deal. They are creating turbogenerators, transformers, custom-made boiler units each with a productivity of 2,650 tons of steam per hour, and many other items of equipment.

However, Minelektrotekhprom has been skidding steadily for almost three years now on one of the future items which is indispensable to the creation of the KATEK electric power stations. An end to this idling is not yet in sight. I am talking about the fate of the 3,200-5,000 kilowatt asynchronous motors which are necessary for the development and manufacture of the thrust blower machines. Without these machines the boiler units cannot operate, without them--neither can the turbines, etc. work.

Everything seemed to be comparatively simple at first. The designers, engineers, and colleagues on technical councils at various levels decided that the association Armelektrozavod/Armenian Electromechanical Plant/ imeni Lenin could manufacture these electric motors. However, according to a statement of its managers, it proved difficult for the plant to carry out the projects and manufacture the required equipment. The Yerevan people explain it this way: they make up to size 19 motors at Armelektrozavod(the size is determined by the maximum outer diameter of the stator) inclusively, and the machines for KATEK are size 21.

The Central Project Design and Manufacturing Bureau for Large Electrical Machinery, located in Leningrad, was apparently also too busy to be concerned with the motors. After having only worked up sketches, it showed that if the length of the motors was sharply increased, then their diameter could be reduced to the necessary size, and therefore Armelektrozavod should not really refuse the job. However, another

series of objections came from Yerevan: the motors, they say, will be unreliable since their increased length adversely affects the operation of the bearings and other important units. Moreover the association has a very small design bureau and all of the plant fittings are suited for the production of machines weighing no more than 30 tons.

If one considers the objections of Armelektrozavod to be persuasive (I am careful not to judge this), then there is another association--Elektrosila [Electric Power] which can make motors of any size or weight and where, as the saying goes, its design and manufacturing forces are not occupied. However, as the Minelektroprom employees explain, the association Elektrosila, in accordance with workload planning, is in a special position--it is entrusted with the most crucial tasks.

One would think that the Deputy Minister of the Electrical Equipment Industry G. P. Voronovskiy must determine whether KATEK is one of the particularly important projects. The VPO Soyuzelektrotyazhmash [All-Union Industrial Association of the All-Union Heavy Industrial Machinery Plant], the association to which Elektrosila belongs, is subordinate to him. However, the deputy minister has not as yet, as is evident, dealt with this task although there have been many requests and reminders to Minelektrotekhprom and specifically to G. P. Voronovskiy. Once at a meeting of the scientific-technical council, one of the representatives of the electrical engineering industry noted that the minimal time period from the start of the development of a large motor to the output of the pilot model was three years, i.e., exactly the same time period which was lost while the documents were circulating through the offices of Minelektrotekhprom.

Now we do not have this minimal period of time. The first power block of Berezovskiy GRES number 1 must provide electric power in 1983. However, Minelektrotekhprom has not taken any concrete steps up to now to carry out this major state task and it is now threatened with failure.

8524
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PROBLEMS AT KOSTROMSKAYA GRES

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 10 Oct 80 p 1

[Article by V. Seliverstov: "After Testing the Turbine"]

[Text] The gigantic 1.2 million kilowatt turbine revolved for the first time at the Kostromskaya GRES a month ago. The test start-up was a success. The turbine generated the rated revolutions, it is true, from steam taken not from its own boiler, since it is still being assembled, but from working boiler units through a temporary arrangement.

"We stopped the turbine the next day to eliminate minor defects. On the whole, we have been satisfied with it," says N. Remezov, Director of the Kostromskaya GRES. "Now all of us are fully confident that the single-design machine will work."

Did anyone really doubt this? If there are doubts, they are of another kind. The fact is that in spite of the successful test start-up of the turbine, there is a lack of confidence that the new power block will become part of the active system, as planned, by the end of this year. The visiting collegium of USSR Minenergo [Ministry of Power and Electrification], which met at the station on the day before the test start-up, recorded on 29 August: the necessary work tempo has not yet been achieved on the power block construction to allow it to be successfully put into active operation. Construction work has fallen behind on the boiler tail piece, fuel oil pump, and along the foot bridges. The installation of the boiler itself, the forced-draft fans, the flue inner shaft, and the underground supply lines has gone extremely slowly. Besides this, the delivery of quarrystone for the construction of the deep water intake system has been delayed and the rolled metal, cement, and soluble glass have not been fully received.

The collegium meeting was attended by representatives of the builders and installers--the chief of the administration V. Kuldoshin, the chief of the sector guiding the boiler unit installation Ye. Mirynshchenko, and others. They made assurances that all measures would be taken. In accordance with these positive statements, a schedule for the most necessary work was established. In particular, as recorded in the collegium protocol, the boiler unit must be ready for hydraulic-pressure tests on 30 September.

"This time period is unrealistic," the chief engineer of the installation sector, L. Talanin, announced two weeks after the collegium at a meeting of the construction project staff.

"Why did you assure the ministry director then," the chief GRES engineer, I. Zubov, was justly outraged.

It turned out that the other time limits approved by the collegium of UkSSR Minenergo were also unrealistic. Thus, the turning over of the foundations under the three blast blower assembly and the start of the acid rinsing of the boiler unit have been hampered. Thus, the over-all testing of the power block, set for 25 November, may also prove to be unrealistic.

The ease with which promises are made is not without motive. Somebody at the construction project is accustomed to uncontrolledness and irresponsibility. Time limits approved by the ministry can be disrupted, expensive equipment can be broken, and no one will be blamed for anything.

The crew of Hero of Socialist Labor L. Maleyev is assembling the last block of the furnace side shield. This structure, 50 meters long, is made of thin parallel pipes. The assembly work is taking place out-of-doors. The day happened to be a rare sunny one, and the installers were hurrying.

"This will be the second one we have installed," Leonid Kuz'mich says. "Somebody managed to break the first one. I do not really want to think about it. The work on that block was not easy for us, but we assembled everything and prepared for the installation. And the next morning we saw it lying uprooted on crane tracks. Do you think that anyone answered for this?"

The pain of the crew chief was understandable, especially since this was not the only incident. The equally expensive block of the convected boiler shaft was broken--and again there were no guilty ones.

The crew of A. Mukhortov, under the leadership of the foreman A. Romanenko, raised the block of the furnace side shield. The crane trolley fell. The cause of the accident, it said in the formal document, was a "deformation of the overhead transporter in the area of a not fully welded construction joint." In the second case--the breaking of the convected shaft block--"the guilty party was the cable which, all of a sudden, unwound and dropped expensive equipment weighing 82 tons from a height of 61 meters."

"Whom do you punish?"--the sector chief Ye. Mirynshchenko says. "In all cases the mechanisms failed. The Zaporozhskiy Power Machine Plant manufactured the KS-50 crane; the Moskovskiy Experimental Installation Equipment Plant made the cable."

It is possible that the mechanisms did fail. However, a true specialist must know with what kind of equipment he is working. And before lifting crucial articles, he certainly ought to be sure that everything is in order.

They have still not dropped the possibility of turning over the special purpose energy block to experimental industrial operation by the end of the year. However, in order for this possibility to become a reality, the construction project leaders must achieve a strict executive discipline and make those who are lax responsible for their oral assurances which are not backed by deeds and actions and not strengthened by calculations.

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CSO: 1822

BRIEFS

BUZACHA PENINSULA OIL PRODUCTION--The one-millionth ton of oil has been taken from the new oil and gas deposits on the Buzacha Peninsula since the start of operations there. The collective of the oil and gas drilling administration Komsomol'skneft' [Komsomol'sk Oil Administration] pledged to fulfill the program for two months of 1981 by the opening day of the party congress. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 47, Nov 80 p 3] 8524

NEW DEPOSIT IN OPERATION--The oil-industry workers of Middle Priob'ye have put a new deposit--the Karamovskoye--into operation. This is the tenth deposit on which the industrial workers of the association Surgutneftegaz [Surgut Oil and Gas Administration] are working. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 47, Nov 80 p 3] 8524

THERMAL ATOMIC POWER STATION--The first thermal atomic station in the Soviet Union is being constructed in Gor'kiy. It will provide hot water and heat for the housing and enterprises of the city. Two reactors with a total capacity of 860 gigacalories per hour are being installed at the station. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 47, Nov 80 p 5] 8524

ENERGY, FUEL SAVINGS--Tursunjada--More than 25,000 additional gigacalories of thermal power have been produced since the beginning of the year at the Tajik Aluminum Plant. At the same time about 4,000 tons of conventional fuel have been saved. This has been achieved thanks to the work the enterprise has successfully carried out on the use of secondary thermal power resources. Specialists of the industrial planning institutes of Moscow, Leningrad, Sverdlovsk, and Tashkent are working with the production workers to solve this important problem. Original power engineering units which permit the more effective utilization of waste gas heat have been created at the plant. They are highly productive, permit the complete use of raw material and fuel power resources, and eliminate environmental pollution. Plans call for the creation in 1981 of an experimental industrial installation which will begin to capture the heat from tempered coke, thereby permitting the reception of more than an additional 200,000 gigacalories of heat per year and the saving of more than 40,000 tons of conventional fuel. [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 23 Nov 80 p 2] 8524

TETS-5 IN KHAR'KOV--TETs-5 has become the largest TETs in Khar'kov. Its second block with a capacity of 120,000 kilowatts has distributed an industrial power current and heat. The start of this unit has permitted a significant improvement in the electric power supply of the enterprises and the population and has led to the closing of a great number of small boiler facilities. [Text] [Moscow IZVESTIYA in Russian 13 Nov 80 p 6] 8524

REFINING STREZHEVOY OIL--Strezhevoy, Tomskaya Oblast--The chief engineer of the administration Strezhevoyneft' [Strezhevoy Oil Administration] F. Badikov lists the requirements for crude oil. It must contain less than 0.2 percent water and only slight mineral salt impurities are tolerated. The norms have been slightly exceeded--the oil has been moved from the lowest group. There are four groups in all. I am acquainted with the freight transport documents. More than four million tons of Siberian oil have been shipped from the Strezhevoy industries. Since March of this year the administration has been yielding only the highest quality oil. What accounts for this--the generosity of the earth, propitiousness of circumstances? Of course, the oil of the North is not all that bad. However, before it leaves for the plants which are thousands of kilometers away, the extracters work very hard to increase its quality. Why drive "dirt" through the pipes? It is cheaper and smarter to improve raw materials on site. The oil-preparation shop, which is connected by steel arteries to all the oil production areas, is a distinctive treatment factory. Considering the space it occupies, this shop with its amount of equipment is more like an imposing plant. Moving from installation to installation, the oil loses the by-product gas and water. The final refinement takes place in huge thermochemical installations. Mineral salts are removed through heating with suitable chemical agents. Then the oil is allowed to stand in reservoirs and is passed to the pipeline workers for transportation. "Even the most intelligent instruments for the present will not replace work experience, and the knowledge of how raw materials behave under various conditions," explains the senior machinist of the thermochemical installation Aleksandr Babich. He has been in the shop since 1974 and developed the first units. In the closing year of the five-year plan, the country will obtain an additional 350,000 tons of excellent Siberian oil. [Excerpt] [Moscow IZVESTIYA in Russian 13 Nov 80 p 1] 8524

NEW BY-PRODUCT GAS USES--Strezhevoy, Tomskaya Oblast--Even last winter in the areas around Nizhnevartovsk and Strezhevoy, one could see the blazing pillars of fire: by-product gas was burning, polluting the surrounding atmosphere, and depleting the already oxygen-poor air which was saturated with marshy fumes. Here high-energy fuel, a most valuable industrial raw material, was destroyed, with harm to society. Now a majority of the tongues of flame at the production areas of the Soviet deposit have gone out: the accompanying gas has gone through pipes to the Nizhnevartovskiy Gas Refinery. The installers laid 61 kilometers of gas pipes in the first half-year and more than three million cubic meters of gas were saved during the months following! Now by-product gas of Middle Priob'ye is going not only to Nizhnevartovsk for treatment. It is supplying heat to the metallurgists of Novokuznetsk, the chemists of Kemerovo, and the machine builders of Novosibirsk. Soon it will begin to heat the homes of almost half a million people in the quickly-growing, young-again ancient Siberian city of Tomsk. [Excerpt] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 18 Oct 80 p 2] 8524

INGURSKAYA GES--The fifth and last power unit of the Ingurskaya GES has become operational. It has added 260,000 kilowatts to the power stream and brought the station to planned capacity. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 46, Nov 80 p 2] 8524

BAKU REFINERY--The planned capacity of the automated complex for refining crude oil at the Baku Plant imeni Vladimir Il'ich has been reached ahead of schedule. Tens of thousands of tons of light petroleum products--gasoline, diesel fuel--have been produced above the plan. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 46, Nov 80 p 2] 8524

NEW GENERATORS--Yerevan--New generators which have gone into series production at the Yerevan association Armelektromash [Armenian Electromechanical Plant] operate equally well in tropical heat and Arctic cold. The creation of these machines resulted from the cooperation of the production workers and specialists of the All-Union Scientific Research Institute of Complex Electrical Equipment. Agreements between the two collectives permitted in this year alone the start of the output of three kinds of electrical machines with increased efficiency. [Text] [Moscow IZVESTIYA in Russian 23 Nov 80 p 1] 8524

YAKUTSK GAS PRODUCTION--Yakutsk--The Yakutsk gas drillers have produced almost three billion cubic meters of natural gas since the start of the five-year plan. During this time they completed the establishment of the Mastakhskiy Gas Production Area, the largest in the republic. An experimental industrial installation for refining by-product gas condensate into a light boiler fuel has been put into operation there. Several hundreds of tons of such fuel have already been produced for enterprises. [Text] [Moscow SEL'SKAYA ZHIZN' in Russian 28 Sep 80 p 1] 8524

NORIL'SK TETS CONSTRUCTION--Noril'sk--The day before the October holiday the first power block of the new TETs in the Noril'sk industrial region was turned over for operation. The structure was erected near the buildings of the Nadezhdinskiy Metallurgical Plant. The first millions of kilowatt hours, generated by the new power block in the month before the onset of the polar night, were poured into the Taymyr power stream as a heavy addition. This land did not see the light of an electric bulb until 15 years after the October Revolution. It was another 10 years before the first Noril'sk TETs generated a current. A new station became operational in each of the last three five-year plans. Henceforward three TETs operating on natural gas and the Khantayskaya GES, united into a powerful energy system, are ready for night, winter, and industrial loads at the level required for the start of the 11th five-year plan. In the new five-year period they will help to construct a fifth station--on the banks of the taiga Kureyka River. [Text] [Moscow IZVESTIYA in Russian 7 Nov 80 p 6] 8524

NEW INDUSTRIAL RESOURCES--In the European part of the republic and in the Urals, at the same time that active enterprises are being renovated and re-tooled, new resources will be introduced at a number of enterprises including the Kursk AES, Stavropol' GRES, Nizhne-Kamsk and Cheboksary GES's, Novgorod Production Association Azot, and the Mikhaylovskiy Iron Ore Combine. They will increase resources for the production of steel and prepared rolled metal. The construction of Plant Atommash, the Novosolikamskiy Potassium Combine, and the Tol'yatti Nitrogen Plant will be continued. Plans call for the renovation of a number of light and food industry enterprises. The demands of the national economy for fuel and raw materials are being satisfied to an ever greater degree by the enterprises of Siberia and the Far East. Large territorial industrial complexes are being formed in these regions. In Western Siberia the construction of the Lokosovskiy Gas Refinery must be completed and 1,300 kilometers of the large Urengoy-Nizhnyaya Tura-Petrovsk gas pipeline must be laid in 1981. Resources for the extraction of oil and gas, the production of methanol, ion-exchange resins, and other products will be introduced. In Eastern Siberia the production of electric power, plastics, chemical fibers, caustic soda, cellulose, electrical engineering industry products, and cement is growing significantly. They plan to continue the construction of the Berezovskaya GRES and Berezovskiy coal pit, and the Krasnoyarskiy Heavy Excavator Plant. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 44, Oct 80 p 8] 8524

OIL, GAS DRILLING--Volgograd--The drillers of the association Nizhnevolzhskneft' /Nizhnevolzhsk Oil Administration/ have fulfilled the five-year plan for the sinking of test wells ahead of schedule. They have also exceeded at the same time the task of increasing explored reserves. The Golubkovskiy and Miroshnikovskiy oil, Yuzhno-Kislovskiy gas, and Lobodinskiy gas condensate deposits have been opened. All of this opens up new perspectives for the oil and gas industry of Nizhniy Povolzh'ye. The Volgograd sinkers during the past five years have given considerable help to their colleagues in the Gur'yevskaya Oblast by drilling a number of 5,000-meter deep wells. They were marked by openings: the Tengizskiy oil and Tazhigali gas deposits were marked on the map during recent years. /Text/ /Moscow SOTSILISTICHESKAYA INDUSTRIYA in Russian 18 Nov 80 p 1/ 8524

NEW OIL PIPELINE--Georgian SSR--Tests of the final kilometers of the new 398-kilometer long Samgori-Batumi oil pipeline have been completed. Georgian oil has arrived at the Batumi Oil Refinery. These kilometers did not come easily for the builders of Glavyuzhtruboprovodstroy/Main Administration for Pipeline Construction in the Southern Areas/. The oil pipeline had to overcome the 1,000-meter high Suramskiy Pass in the Great Caucasus Mountains and all kinds of other obstacles: 142 rivers, 466 canals, 80 highways and railroads. Dozens of kilometers of the line ran through the Kolkhidy swamps. When the builders were approaching the line's 179th kilometer, the Dzirula River blocked their way. The descent to it was so steep that a trench could not be dug in the usual way. A heavy bulldozer was required as an anchor to hold an excavator on the steep slope. A steel cable, holding the excavator on the slope of the bank, was accurately strung. Nikolay Baranov sat at the levers of the machine. And then a fresh trench stretched to the river. The collective of sector number 5, headed by A. Andryukov, time and again outstripped the construction deadlines. /Text/ /Moscow TRUD in Russian 12 Nov 80 p 1/ 8524

LENINGRAD STATE PRIZE WINNERS--Two Leningraders--Viktor Konstantinovich Tarasov and Nikolay Nikolayevich Tikhodeyev--were awarded 1980 USSR state prizes for the creation and introduction of new super-high 750-kilovolt electrical transmissions which provide a connection for the parallel operation of the united power systems of the CEMA countries with the USSR YeES/unified power system/ and the distribution of the power of large AES's. Tarasov is Deputy General Director of the Leningrad Production Association Elektroapparat and Tikhodeyev is corresponding member of the USSR Academy of Sciences and Chief of the Laboratory of the Direct Current Scientific Research Institute. Two other Leningraders--Vyacheslav Vladimirovich Mitor and Aleksandr Nikolayevich Khimich--were awarded prizes for the construction and introduction into operation in the Estonian SSR of the first large-capacity electric power stations in the world operating on local shale fuel. Mitor is a Doctor of Technical Sciences and Deputy General Director of the Scientific Industrial Association for the Research and Design of Power Equipment imeni I. I. Polzunov. Khimich is the chief project engineer of the Leningrad department of the All-Union State Planning Institute Teploelektroproyekt/All-Union State Institute for the Planning of Electrical Equipment for Heat Engineering Structures/. /Text/ /Leningrad LENINGRADSKAYA PRAVDA in Russian 14 Nov 80 p 1/ 8524

CSO: 1822

ENERGY CONSERVATION

FUEL ECONOMY, POSSIBILITIES AND REALITY

Novosibirsk EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA in Russian No 9, Sep 80 pp 114-128

[Article by V. V. Kuleshov, Candidate of Economic Sciences, and V. M. Sokolov, Candidate of Economic Sciences, Institute of Economics and Organization of Industrial Production, Siberian Branch, USSR Academy of Sciences, Novosibirsk]

[Text] Situations frequently arise when there is insufficient fuel and electric power. This occurs, as indicated by the press, not because we produce little but because we do not always have a thrifty attitude toward that produced.

The press has recently devoted much attention to the problem of fuel and energy conservation. An attempt is made in the proposed article to systemize the facts and conclusions contained in a number of publications which usually touch on individual aspects of this problem, very widespread and timely for all sectors of the national economy.

Production and Transport

Let us begin with petroleum, which largely determines the state of the fuel-energy balance. Losses of petroleum already produced occur in tank depots and in other locations where petroleum is prepared for transport and during pumping within the field. The total losses sometimes exceed two percent in the oil fields. Losses continue during refining of oil--an additional 1.5-2 percent of the refined raw material is lost annually here. On the whole losses of this raw material in the basic sectors of the oil and gas industry annually exceed 30 million tons. This is greater than the annual increase of oil production in the country. Moreover, the economists and managers of these sectors admit that losses could be reduced significantly without capital investments; one need only observe more strictly the technical and organizational rules and norms.

Thus, petroleum products are pumped several times from tank to tank during transport. Each pumping is accompanied by losses, the total volume of which reached two million tons. Many complaints are made against the railroad workers. Malfunctioning rail cars and tank cars come into the sidings of oil refining plants. As a result, gasoline, mazut, solar oil and liquefied gas leak out directly onto the railroad tracks. In winter poorly protected valves after tank cars have been steamed freeze up and cannot be closed completely. And before this is discovered the tank car is sometimes empty.

The losses during transport of coal are even greater. For example, during shipment over a distance of 1,000 kilometers, the wind blows off up to one ton of freight from each gondola loaded with fine coal. Almost five million tons of coal remain on the crossties annually for this reason alone. On the whole, according to specialists, each rail car of this fuel produced in the Donbass losses a minimum of two tons of weight enroute from the mine to the customer. Even losses of 5-8 tons from some rail cars have become an ordinary phenomenon which causes no concern either among the miners or among the railroad workers.

The coal must be covered with a special film to reduce losses during shipment. It was proposed as early as the Ninth Five-Year Plan that installations be constructed to cover coal with a protective film. According to orders of Minugleprom [Ministry of the Coal Industry] of the USSR, eight of these installations were supposed to become operational in the Donbass, but their construction was not even begun at the beginning of 1980. But this problem is being solved in the Kuzbass. Previously approximately one million tons of coal was lost annually enroute to the Urals. Innovators of the Abashev Enrichment Plant developed and introduced an installation to apply a special protective film to coal first packed in the rail car. The first trips showed that there were no losses due to wind and the load capacity of the rolling stock was increased. These installations are now being constructed at other enrichment plants of the coal basin as well.

Articles are frequently written in the mass press about the technical solutions, economic and legal measures to conserve crude oil and coal, but losses of them have not yet been reduced but on the contrary are increasing according to the increase of production volumes.

Industrial Consumption

There are a number of reasons which lead to overconsumption of fuel and energy in industry. One of the first positions belongs to deficiencies of rate-setting. Rate-setting assumes well organized accounting. But this has been unsuccessful, especially in thermal energy accounting. At enterprises which have their own boiler plants, heat generation is frequently determined on the basis of rating-plate data of the boilers and the amount of fuel burned. The reduction of boiler efficiency due to incomplete loading and deterioration of combustion conditions is not taken into account.

The attitude toward rate-setting is frequently formal. Cases are known when fuel economy was planned by enterprises at which accounting of heat energy was generally not organized and consequently it is impossible to calculate how much coal or gas is required to produce it.

Fuel expenditures at motor vehicle enterprises comprise approximately one-third of the total expenditures for transport expenses. On modern scales of shipments, conservation of only one percent of the fuel-lubricating materials makes it possible to carry out additional work worth two billion ton-kilometers. At the same time the equipment is filled manually with pails at many industrial enterprises and construction projects. There is no monitoring of filling. Fuel consumption is determined "from thin air."

Quite frequently fuel is overconsumed unwillingly in motor transport. Of 32 percent of the motor pool of Minavtotrans [Ministry of Motor Transport] of the RSFSR operating in northern and eastern regions of the country, only one-third was provided with heated enclosed parking areas. As a result many tens of thousands of tons of fuel are expended for nighttime heating of the vehicles.

Another method of fuel conservation is equipping trucks with trailers. Thus, fuel consumption when performing identical work for the ZIL-130 truck with two trailers is 13 percent less than that for the same truck with a single trailer and one-fourth that than during transport without a trailer.

Bulgarian engineers have developed an experimental model of a diesel engine for the Zhiguli automobile. This automobile will consume only six liters of diesel fuel per 100 kilometers. If 45 percent of the country's vehicles are converted to diesel engines, fuel needs will be reduced by 9.6 million tons.

According to conclusions of workers of the Scientific Research Institute for Highways in Sweden, simple mechanical attachments and improvement of driving techniques make it possible to conserve a very significant amount of fuel. Thus, smooth acceleration and smooth braking, refusal to use the brakes without justification and precise adjustment of the valves and carburetor reduce gasoline consumption by approximately 15 percent. Gasoline consumption is increased by 40 percent with insufficient air pressure in the tires and when the vehicle is overloaded. The optimum speed at which the minimum amount of fuel is consumed is different for different types of vehicles, but is within the range of 45-65 kilometers per hour.

Overconsumption of fuel and energy are also high in those cases when accounting and rate fixing are satisfactory. The impression is created that neither enterprises nor their managers bear any serious responsibility at all for overconsumption. Thus, enterprises of Minugleprom of the Ukrainian SSR overconsume approximately 200 million kW·hr of electric power annually while metallurgists overconsume more than 100 kW·hr due to above-plan losses of compressed air, unsatisfactory sealing of buildings and structures and operation of equipment with load below the nominal.

In 1979 the territorial inspection stations of Gosgaznadoor of the USSR examined 11,000 industrial enterprises. It was established that large gas losses are permitted at the majority of them. This is caused by the low level of equipment operation and the absence of unit and in some cases even of planned accounting of the energy carrier and technically justified norms. Part of the enterprises consume gas without having stocks for it. For example, the Cherepovets Metallurgical Plant consumed six million m^3 of gas per day with planned consumption of 4.9 million m^3.

Throughout the country as a whole, elimination of losses and also widespread use of progressive scientific developments in industrial production may yield an annual saving of approximately 15 billion m^3 of gas. To this should be added that annual gas losses comprise no less than 14-15 billion m^3 due to incomplete combustion alone, according to data of VNIIpromgaz [All-Union Scientific Research Institute of Gas Utilization in the National Economy and of Underground Storage of Petroleum, Petroleum Products and Liquefied Gas]. This is approximately half the increase of gas production in 1979. For comparison, less than nine billion m^3 of gas was produced in the country in 1955.

Yet another effective trend of fuel and energy conservation is the use of secondary energy resources. This is the enormous amount of heat which is lost in industrial production with exhaust gases, hot water, dead steam, red-hot coke, molten metal and slag. To get an idea of how much heat is discharged into the atmosphere through smokestacks alone, it is sufficient to show that the temperature of the exhaust gases of heating furnaces reaches 1,000-1,200°C, that of heat-treating furnaces reaches 600-900°C and that of boiler plants reaches 200-300°C.

There are examples of an economic attitude toward matters here. Thus, the Krasnokholmsk Worsted Combine completely utilizes the heat of exhaust gases. Natural gas consumption (in equivalent calculation) was reduced by one million m^3 annually. The cost of the installations was recovered within three months. On the whole the use of secondary energy resources can save 28-30 million tons of comparison fuel annually on country-wide scales.

Building Construction

Approximately 60 billion m^3 of gas are expended annually in the country in supplying heat to buildings. Not only the volumes of consumption but the specific consumption of fuel for heating public, industrial and agricultural buildings has increased significantly during the past 20-25 years. The reason is a reduction of the requirements on insulation of walls and ceilings. Planning organizations frequently do not take into account the subsequent increase of operating expenditures and the increase of fuel consumption in striving to reduce the cost of buildings.

And specific heat losses by dwellings, previously permitted in our country, exceeded by a factor of 1.5-2 the value of this index accepted in Scandinavian countries. This gap has now increased even more. For example, insulation norms which exceed 3-4-fold those adopted for construction in Moscow have been established in Finland for apartment buildings erected by using government credits. Moreover, three-pane glazing of windows is compulsory there.

A state standard which establishes the level of building insulation has been in operation since 1975 in the GDR. Our climate is considerably more severe, but we have no similar normative document. Moreover, decisions are being made which reduce the requirements on insulation. For example, in 1976 the permissible level of insulation of panel-type walls was unjustifiably reduced by 10-20 percent. These walls are the main "grating" which permits heat loss from buildings to the outside. Many buildings, especially public buildings, are now made with enormous windows. It is hot in these rooms in summer and almost half of all the heat is lost through the windows in winter.

Many types of heat loss in buildings already constructed are unjustified. It is calculated that installation of manually adjustable thermostats on systems in each room and introduction of automatic regulators at heating stations would conserve approximately 20 percent of all the heat used for heating. However, the demand for manually adjustable thermostats exceeds the supply by a factor of 2-2.5. Development of a heating system with automatic facade regulation, proposed by Professor V. P. Turkin, has been supported for more than 20 years by a group of enthusiasts. The lack of the necessary quantity of automatic regulators is given as the main reason which inhibits introduction.

There are other, in no way objective causes of heat losses. According to data of the Scientific Research Institute of Organization and Management in Construction, a large amount of oakum, construction felt and other insulating materials is listed in the "conservation" column of construction organizations in the Komi ASSR. The saving reaches 50 percent for some materials. Oakum and felt simply have no meaning--they are not installed in the proper amounts. As indicated by practice, in winter the temperature is 4-6° below the normal in rooms with poor insulation of windows and doors.

"The Trivia of Life"--An Ocean of Losses

Fuel is also being consumed very inefficiently in the existing heating systems of apartment buildings. Heat exchange is reduced when the systems become dirty, as a result of which the actual temperature of circulating water begins to exceed the norm. This excess may comprise 6-8°. On the scales of Kemerovo alone, the cost of each of these degrees is approximately 2,000 tons of comparison fuel during the season. Moreover, additional hot water must be circulated through the system to provide normal temperature in the dwellings.

According to the Minister of the Gas Industry of the USSR S. A. Orudzhev, 1.6 billion m^3 of gas could be conserved annually in housing-public heating boilers by increasing the technical skills in maintenance of boiler units, operation in optimum modes and also due to utilization of secondary heat.

Domestic consumption of electricity is high--15 percent of the total generated, that is, almost 200 billion kW·hr, was used for these purposes last year. We note that the Krasnoyarskaya GES, the world's largest, generates an average of 20 billion kW·hr annually, while Europe's largest atomic power plant--the Leningradskaya--generates 12 billion kW·hr.

The press and television of a number of cities and oblasts conducted experiments on the use of electric power in apartment buildings. Thus, VECHERNAYA MOSKVA appealed to readers to follow the use of electric power in their own apartments. The rules of the experiment were simple: when one left the room--switch off the light, if one is not watching television, switch it off. The results exceeded all expectations: during one experimental evening the counters of Mosenergo [Moscow Regional Administration of Power System Management] recorded several hundred thousand kilowatt-hours less electricity than during any other evening. Similar experiments were also conducted in Kirov, Kemerovo and other cities and yielded similar results. Elementary accuracy produces an unexpectedly high saving.

In concluding our conversation about fuel and energy conservation, let us present a seemingly curious case from foreign practice which again indicates that there is no trivia in the important matter of conservation. The Japanese Administration of Natural Resources and Power decided to organize a campaign which called upon the male population of the country and primarily white-collar employees to exclude neckties from their daily clothing during the summer season. Officials engaged in problems of fuel supply to the country explain such a strange decision by the desire to increase conservation of petroleum and other fuel resources. The fact is, they explain, that the air temperature in buildings during the summer season will now be maintained at 28°C, which should lead to a significant saving of energy

consumed by air conditioning installations. The authors of this idea take into account that a person without a necktie can more easily tolerate the closeness of administrative offices in summer.

There are opportunities for fuel and electric power conservation in all sectors of the national economy, both in the production and nonproduction spheres. An entire complex of measures is required to implement the program on fuel conservation, which was named among the primary programs in the decree of the CPSU Central Committee and USSR Council of Ministers "On improving planning and intensification of the effect of the economic mechanism to increase production efficiency and work quality." The expenditures for them are usually very small compared to the expected advantage and the periods of implementation are short. They should include production of special film to eliminate losses of coal during shipment, construction of heated parking areas for motor transport at least in northern and eastern regions of the country, an increase of vehicle driving skills, rate-setting of fuel and energy and increasing the responsibility for overconsumption of them, the use of secondary energy resources, regulation of temperature in rooms and apartment buildings and switching off lighted advertisements at nighttime.

Such measures as elimination of losses of casing-head gas, improvement of oil refining technology, increasing the level of converting the motor fleet to diesel engines and introduction of higher insulation norms for walls and ceilings of buildings require considerably higher expenditures of funds and time.

There is a need to improve the management in the producing and consuming sectors. The prices for fuel and electric power are so low that consumers are not interested in maximum economic use of oil, gas, coal, heat and electric power.

Materials from the following newspapers were used in the survey: PRAVDA, 26 June, 18 November and 1 December 1979 and 8 January 1980; IZVESTIYA, 28 March, 29 June, 2 and 20 September, 27 and 28 October and 7, 8, 13 and 14 December, 1979; SOTSIALISTICHESKAYA INDUSTRIYA, 8 and 10 March, 25 and 30 August, 21 September, 16 November and 4 December 1979 and 18 January 1980; VECHERNIY NOVOSIBIRSK, 10 October and other dates, 1979.

Resources and Conservation in Figures

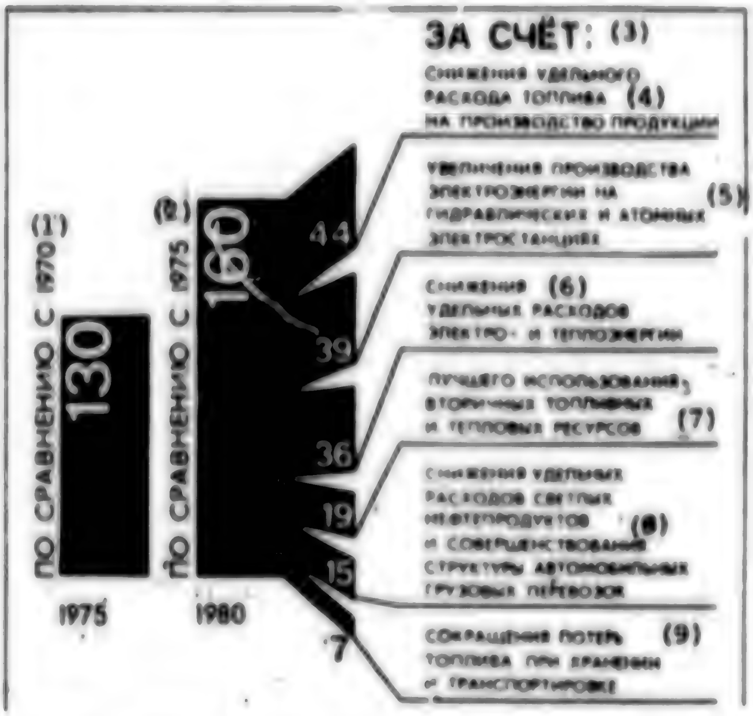
> Regardless of how much the resources of our society increase, the strictest conservation and thriftiness remain the most important condition for development of the national economy and for increasing the standard of living.
> L.I. Brezhnev.

A sampling of statistical illustrations devoted to the problem of fuel and energy conservation is offered to the readers.

The data for 1980 are presented according to the five-year plan for 1976-1980.

The illustrations were prepared on the basis of information contained in the following sources: "Materialy XXV c'yezda KPSS" [Materials of the 25th CPSU Congress], Moscow, Politizdat, 1977; "Narodnoye khozyaystvo SSSR v 1978 g." [The National Economy of the USSR in 1978], Moscow, Statistika, 1979; "Energetika SSSR v 1976-1980 gg." [Power Engineering of the USSR in 1976-1980], edited by A. M. Nekrasov

and M. G. Pervukhin, Moscow, Energetika, 1977; I. Popov and V. Sviridov, "Energy and Materials: Problems of Conservation," NAUKA I ZHIZN', No 1, 1980, pp 50-56.



Conservation of Fuel and Energy Resources, Million Tons of Comparison Fuel

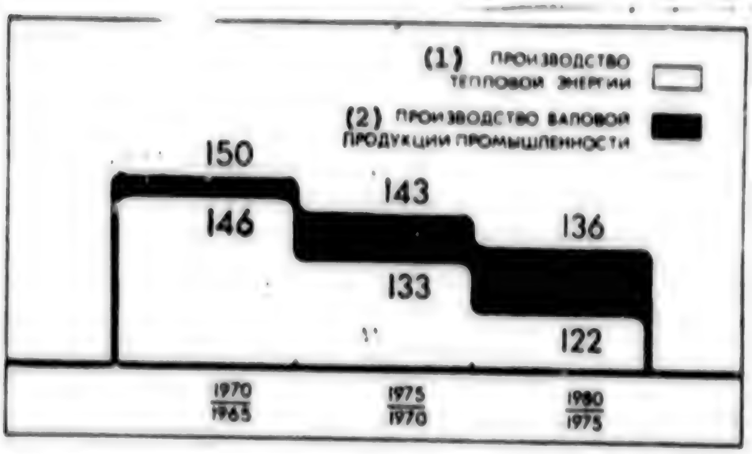
Key:

1. Compared to 1970
2. Compared to 1975
3. By
4. Reducing the specific consumption of fuel for output of products
5. Increasing production of electric energy at hydroelectric and atomic power plants
6. Reducing specific consumption of electric and thermal energy
7. Better utilization of secondary fuel and thermal resources
8. Reduction of specific consumption of light petroleum products and improving the structure of motor freight shipments
9. Reducing fuel losses during storage and transport

Production Capacity of Individual Sectors

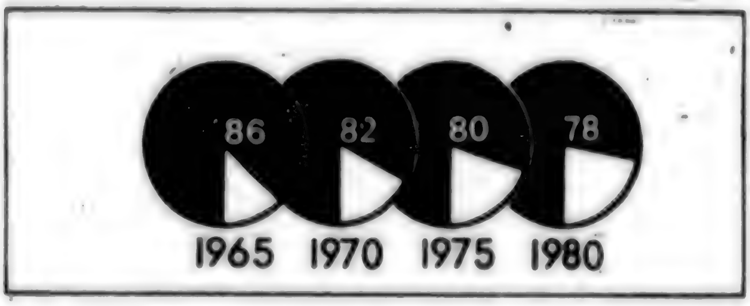
Key:

1. kW·hr/ruble of gross production
2. Chemical and petrochemical industry
3. Fuel industry
4. Industry as a whole
5. Machine building and metalworking
6. kW·hr/thousand ton-kilometers of freight turnover
7. Transport as a whole
8. Railway transport

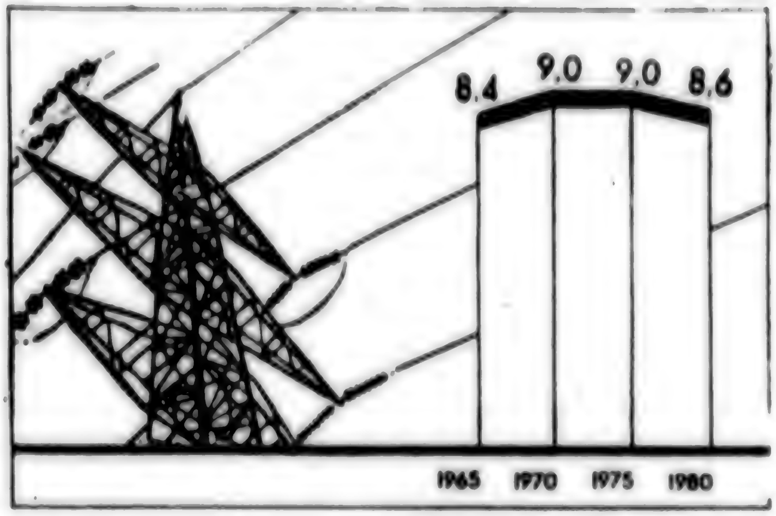


Growth Rates of Industrial Consumption of Thermal Energy (From Centralized Sources), percent

Key:
1. Production of thermal energy
2. Production of gross products of industry



Fraction of Industrial Consumption of Thermal Energy in Total Production By Centralized Sources, percent



Losses of Electric Energy in Electrical Systems in Percent of Output to the System

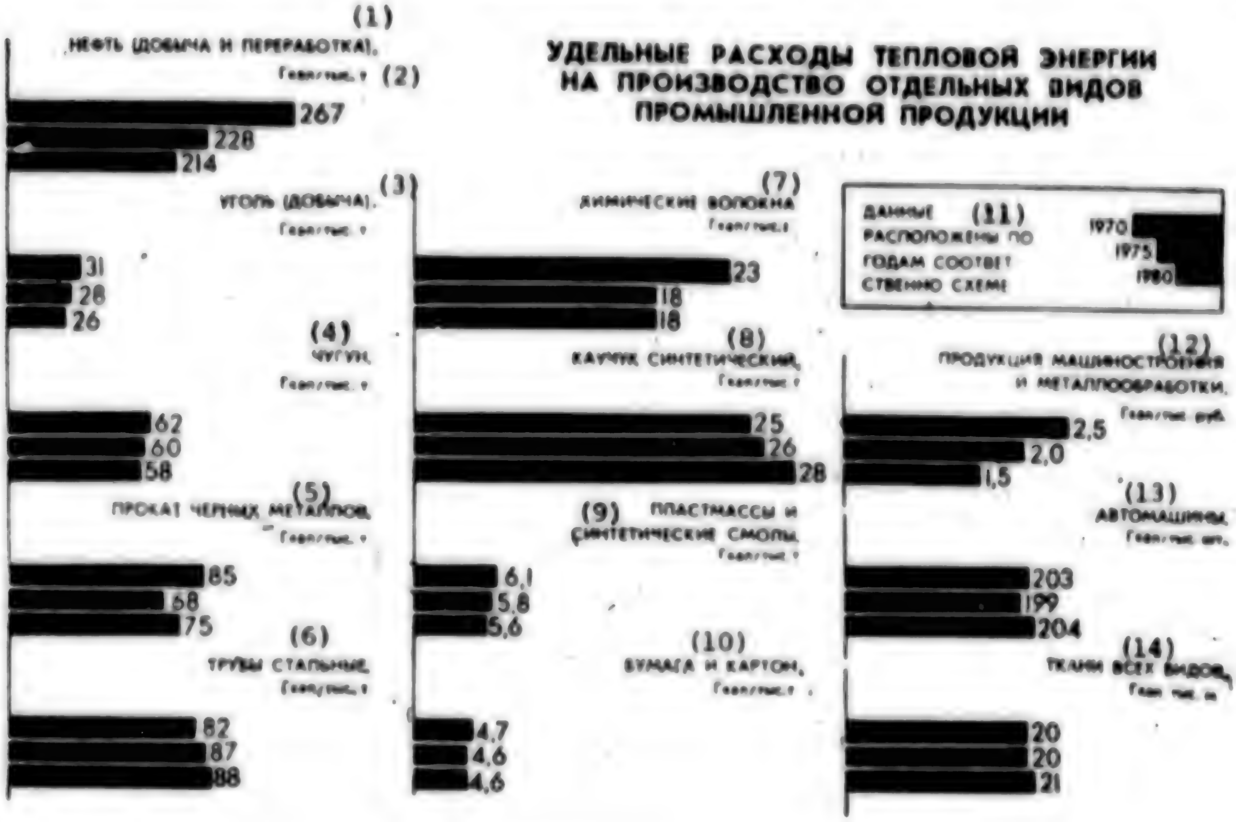
Note. Losses of thermal energy comprised 15 million Gcal in 1970 or 1.1 percent of output to consumers, 20 million (1.1 percent) in 1975 and 85 million Gcal (1.1 percent in 1980).

Specific Consumption of Comparison Fuel to Produce Electric and Thermal Energy

Key:

1. **g/kW·hr of electric energy**
2. **kg/Gcal of thermal energy**

Specific Consumption of Thermal Energy to Produce Individual Types of Industrial Products



Key:

1. Petroleum (production and refining)
2. Gcal/thousand tons
3. Coal (production)
4. Pig iron
5. Rolling of ferrous metals
6. Steel pipe
7. Chemical fibers
8. Synthetic rubber
9. Plastics and synthetic resins
10. Paper and cardboard
11. Data are arranged by years according to the diagram
12. Machine-building and metalworking products
13. Motor vehicles
14. Fabrics of all types

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6521
CSO: 1822

ENERGY CONSERVATION

HEAT RECYCLING DISCUSSED

Moscow SEL'SKAYA ZHIZN' in Russian 30 Sep 80 p 3

[Article by A. Korneyev and V. Farberov, candidates of Biological Sciences, Moscow: "Heat Works Twice"]

[Text] The CPSU Central Committee considered the problem of the operating experience of collectives of ferrous and nonferrous metallurgy and the chemical industry in use of secondary fuel and energy resources. It is emphasized in the adopted decree that use of secondary energy resources in production is one of the most important factors of dependable support of the growing needs of the national economy for fuel and energy and of increasing social production efficiency. The article which we publish today raises the question of energy-biological complexes at existing electric power plants and those under construction.

The efficiency of the most improved electric power plant does not exceed 35 percent. A total of 65 percent of the energy of fuel burned is essentially unused and is partially expended for heating cooled water, which is a source of so-called "thermal pollution of the environment." The rates of development of heat engineering are high. And accordingly the skills of recruiting nonrenewable natural resources--fuel, earth and water--into energy production are just as high.

The most important alternative to this process is development of a system of measures directed toward complex use of natural resources and conversion of thermal pollution zones to their opposite--to zones of intensive food production. Specifically, we are talking about using low-temperature heat with water temperature 10-12 degrees higher than natural temperature.

The idea of using the discharge heat by different sectors of the national economy in so-called energy complexes is not a new one. It was initially accomplished for the first time in the interests of the fishing industry during the early 1960s. A cooling reservoir is populated with plant-eating fish--the amur and silver carp--to suppress aqueous vegetation which interferes with normal cooling of power plant units. Biological amelioration specialists are coping successfully with the task posed to them.

Fishery use of thermal waters achieved further development in organization of pond growing of fish under intensive feeding. Along with carp, trout, sturgeon and

also newcomers to our reservoirs--heat-loving American catfish, ictalurus and buffalo, are being grown successfully in ponds. This method has now achieved wide development both in our country and abroad. More than 20,000 quintals of fish are now being grown in ponds. Some farms, for example, the Cherepetskiy, Tul'skaya Oblast; Volgorechenskiy, Kostromskaya Oblast; and Zmiyevskiy and Mironovskiy, Khar'kovskaya Oblast and others, produce up to 100 kilograms of fish from each square meter of pond area. This increases by several degrees the productivity of open pond fish breeding.

The Gidroproyekt Institute imeni S. Ya. Zhuk [All-Union Planning, Surveying and Scientific Research Institute imeni S. Ya. Zhuk] has conducted experiments over a number of years on development of an essentially new technique of growing fish and on new design solutions corresponding to it. These investigations were the basis for the design of the fish-management complex in the thermal waters of the Kurskaya AES. The capacity of the farm is 2,000 tons of fish annually. The polycyclic technique of year-round growing of fish, used for the first time here, permits total elimination of seasonality in the operation of the enterprise and makes it possible to achieve more complete use of the equipment of the fish farm.

A number of basin farms are now being designed and constructed. Their payback time now comprises 7-8 years. But it is obvious that this period can be reduced to 5-6 years when the technology is developed and improved. According to calculations of fish-management organizations, up to 500,000 tons of high-quality fish can be produced annually in thermal waters.

Another extremely important trend in the use of waste heat is construction of greenhouses. The heat of low-temperature water of thermal and atomic power plants, which is usually discharged into reservoirs and is a source of thermal pollution of them, is utilized here. Vertical greenhouses and cooling tower-greenhouses are attracting special attention.

According to calculations, approximately 300,000 hectares of greenhouses could be heated with the waste heat of existing electric power plants alone. This is equivalent to production of 9-10 million hectares of plowed land located in the subtropical zone in output. One-fourth of all natural gas production in the country would have to be burned to operate this number of traditional greenhouses, whereas the proposed greenhouses essentially utilize free heat.

The proposal of the Institute of Applied Molecular Biology and Genetics of VASKhNIL [All-Union Academy of Agricultural Sciences imeni V. I. Lenin], the Moscow Architectural Institute and Gidroproyekt to develop an energy-biological complex consisting of a fish farm, greenhouses, mushroom cellars and coolers is of great interest. These investigations, carried out under the supervision of VASKhNIL academician N. V. Turbin, were directed toward even more complete utilization of waste heat and development of a waste-free production scheme.

A mushroom farm is also included in the heat-utilizing complex. A temperature of 13-16 degrees, optimum for development and reproduction of mushrooms, is required for its operation. The water discharged by electric power plants can totally provide this temperature. Growing mushrooms is a very profitable business. One hectare of this mushroom cellar can yield up to 1,000-1,200 tons of mushrooms or 40-45 tons of vegetable protein.

Inclusion of a cooling unit which utilizes waste heat by means of a bromine-lithium solution in the complex is quite justified. It is designed for reliable preservation of large volumes of food products.

The use of fish-breeding ponds located in cooling reservoirs for growing agricultural crops on a floating substrata is very interesting.

The use of waste thermal water for irrigation and heating of agricultural crops in open soil is promising. These investigations are being carried out by the Ukrainian Institute of Water Management Engineers on an experimental plot near the Yuzhno-Ukrainskaya AES in Nikolayevskaya Oblast. It has been established that the yield of vegetables has been increased by 18-20 percent as a result of irrigation with warm water.

An important component of an energy-biological complex is enterprises of the microbiological industry, which also require heat for their activity and can utilize the wastes of fish and agricultural production as initial raw material. They will produce valuable products of microbiological synthesis (yeasts and enzymes) and biogas (methane).

An energy-biological complex can be organized at practically every large electric power plant. Perhaps the problem of the need to develop a unified technology of electric power production and food products has reached fruition. Moreover, the techniques must be developed and the objects must be designed simultaneously both for the electric power plant and for the related enterprise to use the waste heat. It is possible in this case to avoid additional outlays related to the need to adapt users to the energy object.

Another method for already existing electric power plants is to adapt the heat use users to the operating mode of the energy object. The effect from the activity of these enterprises is reduced somewhat, but it is sufficiently high to ensure profitable operation.

In short, the most rapid organization of energy-biological complexes is an urgent problem. But, despite the obvious advantage of the new matter, there are still considerable difficulties in the path of wide introduction of it. The necessary scientific bases for organization of energy-biological complexes have not yet been developed due to the absence of a complete experimental base. The relationships between agencies and the lack of desire of any of them to head the problem as a whole cause serious difficulties with regard to the fact that the problem is complex in nature. All this leads to the fact that the idea of developing energy-biological complexes, first generated in our country, is finding its practical application abroad rather than in the Soviet Union. Moreover, some investigators feel that an electric power plant with capacity of two million kilowatts can produce food products for a city with population of 200,000-250,000.

Obviously, effective measures must be adopted so that the most rapid practical embodiment is achieved in our country, which has at its disposal a truly unlimited reserve for development of this important sector of the national economy.

6521
CSO: 1822

FUEL CONSERVATION AT REGIONAL POWER PLANTS

Moscow TRUD in Russian 26 Oct 80 p 2

[Article by N. Remizov, director of Kostromo GRES, Volgorechensk, Kostromskaya Oblast: "The GRES is Under Construction and the GRES is Operating"]

[Text] A great deal of experience has been accumulated both in construction and ahead-of-schedule introduction of capacities and in high operating efficiency of energy equipment at the Kostromskaya GRES, which has entered the final stage of construction. The task of the 10th Five-Year Plan to reduce specific fuel consumption per kilowatt-hour of electric energy has been fulfilled ahead of schedule, as early as last year. Specific consumption comprised 318.8 grams, which is 8.2 grams below the planned level. This indicator is now being surpassed. We have achieved figures of 317.9 grams. Thus, the Kostromo workers will introduce more than 32,000 tons of mazut this year into the receptacle of fuel-energy resources.

A reduction of fuel consumption is the main economic indicator of thermal power plant operation. This is also understandable: after all, more than 80 percent of the cost of electric energy goes to fuel.

How has the collective managed to make the power plant the most economical in the country?

Clear organization of equipment maintenance--strict observation of the given operating modes, operational correction of malfunctions and prevention of them--were primarily responsible.

The competition for the rank "Best in profession," "Best shift" and "Best repair brigade" contributes to an increase of professional skills and to awakening a feeling of responsibility for the entrusted matter among the workers. The well-organized training of personnel serves the same purpose.

A second reserve is innovation. Based on suggestions of innovators, we introduced 625 organizational and technical measures during the current five-year plan, many of which contributed to an increase of reliability and economy of equipment operation.

Here is one of the examples of a creative approach of our specialists and workers toward the struggle for production efficiency. Two-three units do not operate every week on Saturdays and Sundays. This is related to the reduction of energy

consumption on weekends. Approximately eight hours was required to bring each unit to full load at the beginning of the week. After all, each boiler has two housings. First one was fired up and then the other. Our innovators suggested that starting be done simultaneously. To do this, some modifications in the units had to be made: part of the fittings were eliminated, the piping was rerouted and their layout was simplified. The starting time of the unit was reduced. Because of this alone, we achieve tens of tons of conserved fuel weekly. This is only one example.

We also have other reserves. Unfortunately, putting them into operation does not always depend on us. We have long fought over the problem of organizing an economical mode for burning mazut with the lowest possible air surplus. Introducing this mode, we completed a complex of operations in preparation of fuel, equalization of air flow rate through the burners, improvement of the burner devices and nozzles, new devices which monitor underburning of fuel were developed and so on. All this made it possible to raise the efficiency of boiler units to 93-93.5 percent. The assistance of machine and instrument builders is necessary to convert the units to even more economical operation (and not only at our GRES, but at other GRESes as well). For example, centralized manufacture of new devices which monitor combustion and also of devices which provide automatic regulation of boiler operation must be organized. But Minpribor [Ministry of Instrument Making, Automation Equipment and Control Systems] is still not satisfying our requests.

6521
CSO: 1822

UTILIZATION OF SECONDARY FUEL, ENERGY RESOURCES CALLED FOR

Moscow PRAVDA in Russian 14 Oct 80 p 2

[Article by P. Lomako, minister of Nonferrous Metallurgy of the USSR: "Secondary Heat"]

> [Text] The CPSU Central Committee recently reviewed the problem of operating expenses of collectives at ferrous and nonferrous metallurgy and chemical industry enterprises in using secondary fuel and energy resources. It is emphasized in the adopted decree that use of these resources in production is one of the most important factors for reliable support of the national economy in fuel and energy. The published article discusses the struggle of nonferrous metallurgy collectives to make full use of these fuel and energy resources and raises some serious problems.

Approximately 2 billion tons of comparison fuel are consumed annually in our country. Almost 350 million gigacalories are generated by secondary energy resources in almost all production processes related to the use of fuel. And metallurgical conversion is the largest sources of secondary energy resources.

The annual output of secondary energy resources suitable for utilization comprises 17.7 billion gigacalories in nonferrous metallurgy. The rates of recruiting secondary energy resources are increasing constantly. Whereas the average annual increase of thermal energy generation during the Eighth Five-Year Plan was 135,000 gigacalories and was 236,000 during the Ninth Five-Year Plan, this figure was increased to 307,000 gigacalories during four years of the 10th Five-Year Plan. Generation of thermal energy by utilization of secondary resources will increase during the current five-year plan by 1.5 million gigacalories. This is sufficient to support the annual needs of the Krasnoyarsk Aluminum Plant, the Sredneural'sk Copper-Smelting Plant and the Pechenganikel' Combine together.

The economic effectiveness of utilizing secondary energy resources is high. Practice shows that the cost of a single gigacalorie generated in the utility installations of the Elektrotsink Plant is equal to 0.9 rubles, that of the Karabash Copper-Smelting Combine is equal to 0.92 rubles and that of the Yuzhno-Ural'sk Nickel Combine is 1.05 rubles. Whereas the sector receives energy from energy systems at a price of 4-6 rubles, the cost of thermal energy from their own boilers is even higher.

Some enterprises have achieved significant successes in utilization of secondary energy resources. Among them are the firstborn among the country's aluminum industry, the Volkhov Plant. The plant produced 161,000 gigacalories of thermal energy 14 years ago by utilizing these resources. Problems of introducing utility units are at the center of attention of the management of the enterprise and the party organization. The plant operates in close cooperation with the VAMI Institute [All-Union Institute of Aluminum and Magnesium] and the Tsentroenergotsvetmet Association. This cooperation made it possible to increase the output of thermal energy by 69,000 gigacalories during four years of the five-year plan. Utility boilers were reconstructed here and two installations to utilize the heat of discharge gases and a number of other innovations were introduced. Research work is also being carried out and experimental-industrial units are being developed to extract heat from the housings of furnaces. The collective intends to equip all furnaces with special installations by 1983 and to bring utilization of secondary energy resources up to 95 percent. The experience of the Volkhov Aluminum Plant deserves the most serious attention and wide distribution.

Utilization of secondary energy resources produces a significant technological effect. Thus, it would have been impossible to introduce an oxygen blast on shaft furnaces at the Yuzhuralnikel' Combine without converting them to evaporative cooling. Introduction of a new autogenous process of suspended smelting of copper concentrates at the Almalyk Mining and Metallurgical Combine was accomplished by developing efficient heat-utilization equipment.

A permanent committee is operating in the ministry which is involved in problems of operation of various designs of utility boilers, air heaters, evaporative cooling installations for metallurgical units and other equipment. Specialized organizations--Tsentroenergotsvetmet, Uralenergotsvetmet, Sredazenergotsvetmet and Sibenergotsvetmet--have been created and are operating successfully. They manufacture and install utility installations. These organizations help to solve a number of serious problems at enterprises of the sector. For example, the fuel-energy balance was improved, the productivity of production units was increased and their operating life was extended. As a result harmful discharges into the atmosphere were reduced considerably. It should be noted that the level of fuel consumption remained the same with a significant growth of product output during the current five-year plan. The efforts of specialists are now directed toward technical re-equipping and modernization of the energy facilities of the sector.

New utility installations are being developed with regard to complex solution of the problems of energy support, environmental protection, improvement of technology and an increase of the productivity of metallurgical units, maximum automation of all production conversion and reduction of manual labor.

As is known, besides a large amount of heat, harmful substances which pollute the environment and the atmosphere of shops are also discharged into the atmosphere with exhaust gases. At the same time these discharges are a valuable raw material. Thus, sulphur anhydride can be trapped and channelled into production of sulphuric acid. The institutes and enterprises of the sector jointly with the USSR Academy of Sciences are involved in solution of these problems.

The experience of collectives of nonferrous metallurgy permit formulation of the main characteristics which the units being developed should have. These are high

specific and unit productivity, long period between repairs, continuity of processes, multiple use of raw material and fuel-energy resources, maximum automation, elimination of environmental pollution and trapping of valuable components.

The most important trend today is development of energy-production units based on existing metallurgical conversion. Thus, Tsentroenergotsvetmet jointly with VAMI Institute has proposed installations for calcination of petroleum coke, which permits a considerable reduction of harmful discharges into the atmosphere by burning up volatile substances and trapping the heat for recirculation into production tion and also utilization of the energy of discharge gases. Four of these units at the Bratsk Aluminum Plant, besides a significant saving due to improvement of technology, made it possible to produce 186,000 additional gigacalories of thermal energy last year. Similar installations are now being introduced at the Tajik and Krasnoyarsk Aluminum Plants. The Uralenergotsvetmet Association has developed an introduced an energy-producing unit at the Ust'-Kamenogorsk Lead-Zinc combine which permits an increase of furnace productivity by 20 percent, improvement of working conditions and a saving of 6,500 tons of comparison fuel annually. It is planned to install more than 20 of these units in the sector.

As we can see, much has been done. But there are still many unresolved problems. Analysis of the thermal balances of pyrometallurgical processes of nonferrous metallurgy indicate their low efficiency and high losses. This is a significant reserve for fuel conservation and for increasing production effficiency. The problem is complicated by the fact that the considerable variety of techniques for producing nonferrous metals does not permit development of standardized designs of utility boilers and other equipment.

The decree of the CPSU Central Committee places the following task before the managers of industrial associations, sector institutes and enterprises: change the approach to the problem of utilization of secondary energy resources. Each one should recognize responsibility for the unreturned loss of an enormous amount of energy. The experience of the Volkhovskiy Aluminum Plant and the leading enterprises of ther sectors must be used more extensively. The problem can be solved successfully through the joint efforts of the producers and scientists. An important role here belongs to the All-Union industrial associations and to our institutes.

A complex program is now being developed in the sector for bringing secondary energy resources into circulation for the 11th Five-Year Plan. Its implementation will permit a twofold increase of thermal energy production. It is planned to introduce 54 utility boilers, 65 evaporative cooling units, 28 air heaters and other equipment through this program. Approximately 100 million rubles of capital investments are required for this.

Development of secondary energy resources in the sector should be carried out by a single organization from design to introduction. It is important to increase the responsibility of specialized subdivisions to adhere to the deadlines for putting heat-utility installations into operation. The forms of joint actions of metallurgical enterprises, institutes and specialized sectors should be coordinated and improved. Research work on the use of the heat of waste slags, from which one-third of all secondary energy resources, low-potential heat and the chemical energy of waste gases is lost, should also be widely developed.

Tying power engineering to technology at the stage of planning of an enterprise is now one of the most timely problems. But the sector does not have at its disposal a sufficient production base for mass introduction of new engineering solutions. And that developed is capable of being provided with only evaporative cooling installations. The contract subdivisions of specialized construction ministries frequently refuse to work in existing shops of nonferrous metallurgy. And the absence of purposeful centralized financing and material-technical support also delays resolution of this work.

It is feasible that Gosbank of the USSR would provide credits for introduction of heat-utilization equipment costing up to three million rubles with payback up to three years and at the expense of any resources. But the expenditures will hardly be effective while work in the sectors is carried out in a dispersed manner. Intersector individualization does not meet the requirements of time here. The matter proceeds slowly, there is no comparison scale and agencies frequently duplicate research and planning decisions. Coordination of the work of all interested agencies is necessary.

The system of rewarding the achievements of high indicators in this work also needs improvement. It should be such that the activity of the enterprises will be sharply increased in the struggle for conservation of energy resources. An organic relationship of most production processes of nonferrous metals to power engineering raises the question of training of specialists for the sector in higher and secondary educational institutions and vocational-technical schools.

Daily attention in each collective must be devoted to increasing efficient use of fuel-energy and raw material resources. By conserving fuel and thermal and electrical energy, we will strengthen the national economic potential of our country and will increase the efficiency of social production.

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